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PTO/SB/05 (4/98)
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UTILITY PATENT APPLICATION TRANSMITTAL (Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))	Attorney Docket No.	TM00-005.US
	First Inventor or Application Identifier	Hadi Partovi
	Title	See 1 in Addendum
	Express Mail Label No.	EL589016776US

APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents.	ADDRESS TO: Assistant Commissioner for Patents Box Patent Application Washington, DC 20231	
1. <input checked="" type="checkbox"/> * Fee Transmittal Form (e.g., PTO/SB/17) (Submit an original and a duplicate for fee processing)	5. <input type="checkbox"/> Microfiche Computer Program (Appendix)	
2. <input checked="" type="checkbox"/> Specification [Total Pages 24] (preferred arrangement set forth below) <ul style="list-style-type: none">- Descriptive title of the Invention- Cross References to Related Applications- Statement Regarding Fed sponsored R & D- Reference to Microfiche Appendix- Background of the Invention- Brief Summary of the Invention- Brief Description of the Drawings (if filed)- Detailed Description- Claim(s)- Abstract of the Disclosure	6. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary) <ul style="list-style-type: none">a. <input type="checkbox"/> Computer Readable Copyb. <input type="checkbox"/> Paper Copy (identical to computer copy)c. <input type="checkbox"/> Statement verifying identity of above copies	
3. <input checked="" type="checkbox"/> Drawing(s) (35 U.S.C. 113) [Total Sheets 3]	ACCOMPANYING APPLICATION PARTS 7. <input checked="" type="checkbox"/> Assignment Papers (cover sheet & document(s)) 8. <input type="checkbox"/> 37 C.F.R. § 3.73(b) Statement (when there is an assignee) <input checked="" type="checkbox"/> Power of Attorney 9. <input type="checkbox"/> English Translation Document (if applicable) 10. <input type="checkbox"/> Information Disclosure Statement (IDS)/PTO-1449 <input type="checkbox"/> Copies of IDS Citations 11. <input type="checkbox"/> Preliminary Amendment 12. <input checked="" type="checkbox"/> Return Receipt Postcard (MPEP 503) (Should be specifically itemized) 13. <input checked="" type="checkbox"/> * Small Entity Statement(s) <input type="checkbox"/> Statement filed in prior application (PTO/SB/09-12) Status still proper and desired 14. <input type="checkbox"/> Certified Copy of Priority Document(s) (if foreign priority is claimed) 15. <input type="checkbox"/> Other:	
4. Oath or Declaration [Total Pages 4] <ul style="list-style-type: none">a. <input checked="" type="checkbox"/> Newly executed (original or copy)b. <input type="checkbox"/> Copy from a prior application (37 C.F.R. § 1.63(d)) (for continuation/divisional with Box 16 completed)<ul style="list-style-type: none">i. <input type="checkbox"/> DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).		
* NOTE FOR ITEMS 1 & 13 IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).		

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:
☒ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: 60/201,328
Prior application information: Examiner _____ Group / Art Unit: _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

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Attachment to PTO/SB/05 (4/98) Utility Patent Application
Transmittal

1. A Voice and Telephone Keypad Based Data Entry Method for Interacting with Voice Information Services

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Partovi, Hadi; Brathwaite, Roderick Steven; Bryan, David; Belldina, Jeremy; and Arons, Barry

Application No.: Not Yet Assigned

Filed on: Herewith

Title: A Voice and Telephone Keypad Based Data Entry Method for Interacting with Voice Information Services

**STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(b))--SMALL BUSINESS CONCERN**

I hereby state that I am an official of the small business concern empowered to act on behalf of the concern identified below:

Tellme Networks, Inc.
1310 Villa Street
Mountain View, CA 94041

I hereby state that the above identified small business concern qualifies as a small business concern, as defined in 13 CFR 121.12, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees to the United States Patent and Trademark Office under Sections 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third-party or parties controls or has the power to control both.

I hereby state that rights under contract or law have been conveyed to, and remain with, the small business concern identified above, with regard to the invention described in the specification filed herewith, with title as listed above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights in the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c), if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

No such person, concern, or organization exists.

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of

the issue fee or any maintenance fee due after the date on which status as a small business entity is no longer appropriate. (37 CFR 1.28(b))

Hadi Partovi
1310 Villa Street
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USA

SIGNATURE



Date

7/24/2000

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A VOICE AND TELEPHONE KEYPAD BASED DATA ENTRY METHOD FOR INTERACTING WITH VOICE INFORMATION SERVICES

Reference to Related Application

This application is a continuation of, incorporates by reference, and claims priority from U.S. Provisional Application Serial No. 60/201,328, filed on 5 May 2000, entitled "A Voice and Telephone Keypad Based Data Entry Method for Interacting with Voice Information Services".

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates in general to methods for receiving an alphanumeric input string entered using a telephone keypad and for confirming the intended input string using voice prompts, and in particular to an identification method that permits the recognition and confirmation of input strings entered with one keystroke per input string character.

Description of the Related Art

Commercially available voice recognition hardware and software systems have become relatively sophisticated and can recognize words and phrases with a reasonably high degree of accuracy. Accordingly, such voice recognition systems have been used to implement voice user interfaces deployed in messaging systems, vehicles, computers,

telephony, and other applications. In such systems, similar sounding words may be difficult to distinguish, as may be words spoken in an unusual accent, and the like. Noise (e.g., line noise or noise originating at the sound source) and dropouts typical in telephonic applications can also adversely impact speech recognition accuracy. Accordingly, a telephone keypad type data input method can be a useful adjunct to a voice recognition system for noisy environments, for use in further distinguishing from among similar sounds, or for applications that are to be made available to a broad user base having disparate accents or dialects.

Currently, most touch tone (i.e., dual-tone multi-frequency code or DTMF code) data entry systems utilize a two-keystroke-per-alphanumeric-character text input system, due to the fact that standard telephone keypads do not assign a unique key to each alphanumeric character but instead assign several alphanumeric characters to each individual key. Typically, the first key in each two-key sequence is used to identify a distinct character set, and the second key is used to identify specific character within the set. For example, a telephone query to a stock quote system might require an entry of a sequence such as 6, 1, 7, 3, 3, 3, 8, 1 to input a ticker symbol such as MSFT (i.e., M=<6,1> S=<7,3>, F=<3,3>, T=<8,1>). While such an entry method is accurate, it is slow, cumbersome, potentially confusing, and difficult to learn.

Conversely, if a single key per character input method is employed in an application to enter alphanumeric information, the resultant input sequence may not contain sufficient information to precisely and uniquely determine the specific alphanumeric string intended, and therefore the number of potentially correct responses can be quite large and therefore difficult to present to the user in a readily useful manner.

BRIEF DESCRIPTION OF THE FIGURES

Fig. 1 illustrates a system including embodiments of the invention used to provide personalized content to users of telephones according to telephone identifying information.

Fig. 2 illustrates the components of a voice portal supporting personalized content.

Fig. 3 is a process flow diagram supporting the method of entering and confirming input data entered via a keypad.

SUMMARY OF THE INVENTION

A method for retrieving, ordering, presenting and confirming data retrieved in response to user input entered using one keystroke per input string character is described. In one embodiment, a telephone keypad may be used to enter the input data, which input data is used to select a set of potentially matching results. The results are ordered by a weighting factor, which can for example be based on popularity, historical usage statistics, or other criteria, and then the results are presented verbally over the telephone as an ordered list. The user can then either use a further keystroke to uniquely identify the number of the item on the ordered list, or alternatively, the user can speak the number of the desired item.

DETAILED DESCRIPTION

Introduction

A method of recognizing and confirming information entered via a keypad in a voice recognition application is described. The method is presented in the context of a voice portal for presenting personalized content over a telephone interface, but it should be recognized that the method is more generally applicable to telephone keypad type data entry systems used in conjunction with a voice application. The described voice portal allows users of telephones, including cellular telephones, to access a voice portal by dialing a phone number to listen to personalized content. The information provided over the voice portal may come from the World Wide Web (WWW), databases, third parties, and/or other sources.

The term voice portal refers to the capability of various embodiments of the invention to provide customized voice and/or audio content services to a caller. The voice portal can recognize dual-tone multi-frequency ("DTMF") touch-tone commands as well as spoken commands to further control the voice and/or audio content presented and the manner of presentation.

Embodiments of the invention use telephone identifying information to personalize caller interactions with the voice portal. This allows the system to present highly customized information to each caller based on a personal profile the system associates with the telephone identifying information.

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The invention will be described in greater detail as follows. First, a number of definitions useful to understanding the invention are presented. Then, the hardware and software architecture is presented in the System Overview. Then, a following section describes the keypad entry features provided by embodiments of the invention.

Definitions

1. Telephone Identifying Information

For the purposes of this application, the term telephone identifying information will be used to refer to automatic number identification (“ANI”) information, caller identification (“CID”) information, and/or some other technique for automatically identifying the source of a call and/or other call setup information. For example, ANI information typically includes a dialed number identification service (“DNIS”). Similarly, CID information may include text data including the subscriber's name and/or address, e.g., "Jane Doe". Other examples of telephone identifying information might include the type of calling phone, e.g. cellular, pay phone, and/or hospital phone.

Additionally, the telephone identifying information may include wireless carrier specific identifying information, e.g., location of wireless phone, etc. Also, signaling system seven (“SS7”) information may be included in the telephone identifying information.

2. User Profile

A user profile is a collection of information about a particular user. The user profile typically includes collections of different information of relevance to the user,

e.g., account number, name, contact information, user-id, default preferences, and the like. Notably, the user profile contains a combination of explicitly made selections and implicitly made selections.

Explicitly made selections in the user profile stem from requests by the user to the system. For example, the user might add business news to the main topic list. Typically, explicit selections come in the form of a voice, or touch-tone command, to save a particular location, e.g., "Remember this", "Bookmark it", "shortcut this", pound (#) key touch-tone, etc., or through adjustments to the user profile made through a web interface using a computer.

In contrast, implicit selections come about through the conduct and behavior of the user. For example, if the user repeatedly asks for the weather in Palo Alto, California, the system may automatically provide the Palo Alto weather report without further prompting. In other embodiments, the user may be prompted to confirm the system's implicit choice, e.g., the system might prompt the user "Would you like to include Palo Alto in the standard weather report from now on?"

Additionally, the system may allow the user to customize the system to meet her/his needs better. For example, the user may be allowed to control the verbosity of prompts, the dialect used, and/or other settings for the system. These customizations can be made either explicitly or implicitly. For example if the user is providing commands before most prompts are finished, the system could recognize that a less verbose set of prompts is needed and implicitly set the user's prompting preference to briefer prompts.

3. Topics and Content

A topic is any collection of similar content. Topics may be arranged hierarchically. For example, a topic might be business news, while subtopics might include stock quotes, market report, and analyst reports. Within a topic different types of content are available. For example, in the stock quotes subtopic, the content might include stock market index quotes. The distinction between topics and the content within the topics is primarily one of degree in that each topic, or subtopic, will usually contain several pieces of content.

4. Qualified

The term qualified as it is used in this application refers to whether or not a particular user being presented an advertisement, or other material, meets the demographic and/or psychographic profile requirements for that advertisement, or content. For example, a San Francisco-based bookstore might request that all listeners to its advertisement be located in a particular part of the San Francisco Bay Area. Thus, a user of the system would be qualified if she lived in the designated part of the San Francisco Bay Area.

Different embodiments of the invention may qualify users of the system according to different requirements. For example, in some instances advertising, or content, is qualified solely based on telephone identifying information. In other embodiments the telephone identifying information is used in conjunction with other information such as an associated user profile, a reverse telephone number lookup for locale demographics, and/or other information.

5. Locale

As used in this application, the term locale refers to any geographic area. The geographic area may be a neighborhood, a city, a county, a metropolitan region, a state, a country, a continent, a group of countries, and/or some other collection of one or more geographic areas, e.g. all United State major metropolitan areas.

For this reason, a single user of the system may be considered to be in several locales. For example, a caller from Palo Alto, California, might be in the Palo Alto locale, a Silicon Valley locale, a San Francisco Bay Area locale, a Northern California locale, a California state locale, a western states locale, and a United States locale.

Thus, the telephone identifying information for a single telephone number can be mapped to a number of system-defined locales.

6. Voice Character

The term voice character as it is used in this application refers to all aspects of speech pronunciation including dialect, speed, volume, gender of speaker, pitch, language, voice talent used, actor, characteristics of speech, and/or other prosody values. Users can adjust the voice character of the system by changing their voice character settings.

For example, an elderly user could select voice character settings that provide louder volume and slower speech. Similarly, a caller from the South could adjust the voice character settings to support a Southern dialect.

7. Demographic and Psychographic Profiles

Both demographic profiles and psychographic profiles contain information relating to a user. Demographic profiles typically include factual information, e.g., age, gender, marital status, income, etc. Psychographic profiles typically include information about behaviors, e.g., fun loving, analytical, compassionate, fast reader, slow reader, etc. As used in this application, the term demographic profile will be used to refer to both demographic and psychographic profiles.

System Overview

First, the hardware and software architecture of a system including an embodiment of the invention will be described with reference to Figures 1-2. Figure 1 illustrates a system including embodiments of the invention used to provide personalized content to users of telephones according to telephone identifying information. The system of Figure 1 can be used to allow users of standard telephones and cellular telephones to access a voice portal with personalized content from their telephones.

The following lists the elements of Figure 1 and describes their interconnections. Figure 1 includes a telephone 100, a cellular telephone 101, a computer 102, a telephone network 104, an Internet 106, a telephone gateway 107, a web server 108, a voice portal 110, a shared database 112, and a personalized site 130. The cellular telephone 101 and the telephone 100 are coupled in communication with the telephone network 104. The telephone network 104 is coupled in communication with the telephone gateway 107. The telephone gateway 107 is coupled in communication with the voice portal 110. The

computer 102 is coupled in communication with the Internet 106. The Internet 106 is coupled in communication with the web server 108. The voice portal 110 and the web server 108 are coupled in communication with the shared database 112. The personalized site 130 is coupled in communication with the Internet 106.

The following describes each of the elements of Figure 1 in greater detail. The use of each of the elements will be described further in conjunction with the sections describing the personalization features.

The telephone 100 and the cellular telephone 101 are two different telephone interfaces to the voice portal 110. The telephone 100 and the cellular telephone 101 may be any sort of telephone and/or cellular telephone. For example, the telephone 100 or the cellular telephone 101 may be a land line phone, a PBX telephone, a satellite phone, a wireless telephone, and/or any other type of communication device capable of providing voice communication and/or touch-tone signals over the telephone network 104. However, any audio signal carrying interface could be used.

The telephone network 104 may be the public switched telephone network ("PSTN") and/or some other type of telephone network. For example, some embodiments of the invention may allow users with a voice over Internet Protocol ("IP") phone to access the voice portal 110. The telephone network 104 is coupled to the telephone gateway 107 that allows the voice communications and/or touch-tone signals from the telephone network 104 to reach the voice portal 110 in usable form. Similarly, the telephone gateway 107 allows audio signals generated by the voice portal 110 to be sent over the telephone network 104 to respective telephones, e.g. the telephone 100. The telephone network 104 generally represents an audio signal carrying network.

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The computer 102 is a computer such as a personal computer, a thin client computer, a server computer, a handheld computer, a set top box computer, and/or some other type of visual web browsing device. The computer 102 is coupled in communication with the Internet 106, e.g., by a dial-up connection, a digital subscriber loop (DSL), a cable modem, and/or some other type of connection. This allows the computer 102 to communicate with the web server 108. The computer 102 typically provides a visual interface to the WWW and the web server 108 using web browsing software such as the Internet Explorer™ browser from Microsoft Corporation, Redmond, Washington.

Both the web server 108 and the voice portal 110 are capable of communicating with the shared database 112 to register users, build personal profiles implicitly and/or explicitly as will be described more fully below. The database 112 stores profiles for each user based on an association between one or more pieces of telephone identifying information and a particular user. Thus, the database may have a profile for a user Sarah Smith that is keyed to her home telephone number, e.g., 650-493-####. Additionally, Sarah could associate other numbers, e.g., work, cellular, etc., with her profile either implicitly, e.g., by repeatedly calling the voice portal 110 from those numbers, or explicitly, e.g., by adding those numbers to the system directly.

In some embodiments, an existing profile for a web-based portal is adapted for use by the voice portal 110 by associating one or more telephone numbers with the existing profile as stored in the shared database 112. In these embodiments, the existing profile may be further modified for use with the voice portal 110 to allow for different preferences between the web and the voice interfaces.

The call flow arrows 114-122 shown on Figure 1 will be described in greater detail below.

Figure 2 illustrates the components of a voice portal supporting personalized content. This could be used to support the voice portal 110 and provide personal content as described above.

The following lists the elements of Figure 2 and describes their interconnections. The voice portal 110 is coupled in communication with the telephone gateway 107. The voice portal 110 includes a call manager 200, an execution engine 202, a data connectivity engine 220, an evaluation engine 222 and a streaming engine 224. Additionally, Figure 2 includes elements that may be included in the voice portal 110, or which may be separate from, but coupled to, the voice portal 110. Thus Figure 2 also includes a recognition server 210, a text-to-speech server 214, an audio repository 212, the shared database 112, a database 226, the Internet 106, a database 228, and a web site 230. The call manager 200 within the voice portal 110 is coupled to the execution engine 202. The execution engine 202 is coupled to the recognition server 210, the text-to-speech server 214, the audio repository 212, data connectivity engine 220, the evaluation engine 222, and the streaming engine 224. The data connectivity engine 220 is coupled in communication with the shared database 112, the database 226, and the Internet 106. The Internet 106 is coupled in communication with database 228 and the web site 230.

The following describes each of the elements of Figure 2 in greater detail. The use of each of the elements will be described further in conjunction with the sections describing the personalization features.

Typically, the voice portal 110 is implemented using one or more computers. The computers may be server computers such as UNIX workstations, personal computers and/or some other type of computers. Each of the components of the voice portal 110 may be implemented on a single computer, multiple computers and/or in a distributed fashion. Thus, each of the components of the voice portal 110 is a functional unit that may be divided over multiple computers and/or multiple processors. The voice portal 110 represents an example of a telephone interface subsystem. Different components may be included in a telephone interface subsystem. For example, a telephone interface subsystem may include one or more of the following components: the call manager 200, the execution engine, the data connectivity 220, the evaluation engine 222, the streaming subsystem 224, the audio repository 212, the text-to-speech 214 and/or the recognition engine 210.

The call manager 200 is responsible for scheduling call and process flow among the various components of the voice portal 110. The call manager 200 sequences access to the execution engine 202. Similarly, the execution engine 202 handles access to the recognition server 210, the text-to-speech server 214, the audio repository 212, the data connectivity engine 220, the evaluation engine 222 and the streaming engine 224.

The recognition server 210 supports voice, or speech, recognition. The recognition server 210 may use Nuance 6TM recognition software from Nuance Communications, Menlo Park, California, and/or some other speech recognition product. The execution engine 202 provides necessary grammars to the recognition server 210 to assist in the recognition process. A grammar is set of syntactical constraints that define the set of word and/or phrase utterances that can be recognized. The results from the

recognition server 210 can then be used by the execution engine 202 to further direct the call session. Additionally, the recognition server 110 may support voice login using products such as Nuance Verifier™ and/or other voice login and verification products.

The text-to-speech server 214 supports the conversion of text to synthesized speech for transmission over the telephone gateway 107. For example, the execution engine 202 could request that the phrase, "The temperature in Palo Alto, California, is currently 58 degrees and rising" be spoken to a caller. That phrase would be translated to speech by the text-to-speech server 214 for playback over the telephone network on the telephone (e.g., the telephone 100). Additionally the text-to-speech server 214 may respond using a selected dialect and/or other voice character settings appropriate for the caller.

The audio repository 212 may include recorded sounds and/or voices. In some embodiments the audio repository 212 is coupled to one of the databases (e.g., the database 226, the database 228, and/or the shared database 112) for storage of audio files. Typically, the audio repository server 212 responds to requests from the execution engine 202 to play a specific sound or recording.

For example, the audio repository 212 may contain a standard voice greeting for callers to the voice portal 110, in which case the execution engine 202 could request play-back of that particular sound file. The selected sound file would then be delivered by the audio repository 212 through the call manager 200 and across the telephone gateway 107 to the caller on the telephone, e.g., the telephone 100. Additionally, the telephone gateway 107 may include digital signal processors ("DSPs") that support the generation of sounds and/or audio mixing.

The execution engine 202 supports the execution of multiple threads with each thread operating one or more applications for a particular call to the voice portal 110. Thus, for example, if the user has called in to the voice portal 110, a thread may be started to provide her/him a voice interface to the system and for accessing other options.

In some embodiments of the invention an extensible markup language (“XML”)-style language is used to program applications. Each application is then written in the XML-style language and executed in a thread on the execution engine 202. In some embodiments, an XML-style language such as VoiceXML from the VoiceXML Forum, <<http://www.voicexml.org/>>, is extended for use by the execution engine 202 in the voice portal 110.

Additionally, the execution engine 202 may access the data connectivity engine 220 for access to databases and web sites (e.g. the shared database 112, the web site 230), the evaluation engine 222 for computing tasks and the streaming engine 224 for presentation of streaming media and audio. The streaming engine 224 may allow users of the voice portal 110 to access streaming audio content, or the audio portion of streaming video content, over the telephone interface. For example, a streaming media broadcast from ZDNet™ could be accessed by the streaming engine 224 for playback through the voice portal.

The data connectivity engine 220 supports access to a variety of databases including databases accessed across the Internet 106, e.g. the database 228, and also access to web sites over the Internet such as the web site 230. In some embodiments the data connectivity engine can access standard query language (SQL) databases, open database connectivity databases (“ODBC”), and/or other types of databases. The shared

database 112 is represented separately from the other databases in Figure 2; however, the shared database 112 may in fact be part of one of the other databases, e.g., the database 226. Thus, the shared database 112 is distinguished from other databases accessed by the voice portal 110 in that it contains user profile information.

Having described the hardware and software architecture supporting various embodiments of the invention, the various features provided by different embodiments of the invention will now be described.

In a first embodiment of the invention, a DTMF (i.e., touch tone) keypad input method is used as a backup interaction mode for navigating the voice portal. Such a mode can be useful in noisy environments where voice input is problematic. In other embodiments, the touch tone keypad input method may be implemented simply as a convenient alternative input method.

Turning to Figure 3, the process of entering and responding to user keypad input is described. At step 300, the user inputs data via the telephone keypad using a single keystroke for each alphanumeric character. This step occurs after the user has initiated a call and connected to the voice portal 110. Thereafter, at step 310, the voice portal 110 receives the DTMF tones corresponding to the user keypad input. Next at step 320, the voice portal 110 compares the keypad input to the valid keyword list and gets a list of those valid keywords that have initial letters corresponding to the keypad input and sorts them by a weighting factor associated with each valid keyword, e.g., popularity or probability based upon historical access frequency. It should be noted that the keywords may also be sorted by any other weighting factor assigned to each keyword by the system operator.

Three different embodiments will now be considered, according to the first two embodiments, the process continues from step 320 to step 330. At step 330, the voice portal 110 verbally plays back the sorted list of keywords whereupon the user may either enter a numerical keypad response to select an item on the sorted list, or alternatively, the speaker may speak the number of the item on the sorted list, whereupon the voice portal 110 will at step 350 play back the response appropriate to the selected item over the telephone.

According to an alternative embodiment, at step 330, the voice portal is programmed to sequentially play back the responses associated with each of the items on the sorted list, or alternatively, the response associated with the first n items of the sorted list, where n is an integer that may be selected by the voice portal operator. This can be accomplished by repeatedly looping through step 350 from step 330 for each of the items to be played back.

An example user interaction with voice portal 110 in a preferred embodiment is as follows:

[VP] "Please enter the stock ticker symbol followed by a # sign."

[User] 6, 7, 3, 8, # (i.e., DTMF input corresponding to MSFT#)

[VP] "There are 3 companies that match that entry. To skip ahead, press 6. To go back, press 4."

[VP] "Microsoft Corporation, up 1-3/8 to 82-5/16. Magellan Petroleum, down 1/16 to 1-7/32. Objectsoft up 1/32 to 1-11/16. That's all the quotes.
What's the next company?"

In yet another embodiment of the invention, after the voice portal gets the list of valid keywords at step 320 and then the process continues at step 340. The voice portal 110 context is set to a restricted grammar that recognizes only the keywords in the valid keyword list (and optionally, any other command or escape keywords that may be desired) and prompts the user to speak the name of the item desired. By using such a restricted grammar, voice recognition accuracy can be increased, and upon recognizing the spoken item, the voice portal can then play the response associated with the spoken item.

An example dialogue in an alternative embodiment is as follows:

[VP] "Please enter the stock ticker symbol followed by a # sign."

[User] 6, 7, 3, 8, # (i.e., DTMF input corresponding to MSFT#)

[VP] "There are 3 companies that match that entry. To select a company, please say the name of the company or enter the number of the company at any time. The first match is Microsoft Corporation. The second match is Magellan Petroleum. The third match is Objectsoft. That's all the matching companies."

[User] "Microsoft."

[VP] "Microsoft Corporation, up 1-3/8 to 82-5/16. What's the next company?"

According to some embodiments, the list of matches is not played back during step 340 unless user input is not received after a pre-determined period. The restricted grammar can rank items by their likelihood of being chosen, thus in addition to being limited to the few valid choices, the speech recognition engine can be programmed to favor more commonly selected items.

The foregoing description of various embodiments of the invention has been presented for purposes of illustration and description. It is not intended to limit the invention to the precise forms disclosed. Many modifications and equivalent arrangements will be apparent to those skilled in the art.

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THE CLAIMS

What is claimed is:

1. In an interactive voice response system having a telephone interface, a method of responding to a DTMF-input-sequence made by a caller on a telephone style keypad using a single keystroke per alphanumeric character, the method comprising:
 - receiving the DTMF-input-sequence over the telephone interface;
 - selecting from a plurality of alphanumeric string tokens, wherein each alphanumeric string token of the plurality has an associated weighting factor, a subset of alphanumeric string tokens in which each alphanumeric string token in the subset is mapped in accordance with the telephone style keypad to a numeric sequence equivalent to the DTMF-input-sequence;
 - sorting the subset according to the weighting factor to generate a sorted list of alphanumeric string tokens; and
 - for each alphanumeric string token in the sorted list, successively playing a corresponding audio message.
2. The method of claim 1, wherein the weighting factor is a probability.
3. The method of claim 2, wherein the probability is calculated from a historical access distribution.

4. The method of claim 3, wherein the DTMF-input-sequence is delimited by a selected terminal keystroke input.

5. The method of claim 4, wherein the playing pauses after a predetermined number of corresponding audio messages has been played.

6. The method of claim 5, wherein the alphanumeric string tokens are stock exchange ticker symbols.

7. The method of claim 5, wherein the alphanumeric string tokens are company names.

8. In a computer system that provides an audio user interface, a method of interfacing with a user comprising the steps of:

prompting the user for an input;

in response to receiving the input in the form of a DTMF-input-sequence

delimited by a terminating character, selecting from a plurality of audio tokens,

wherein each audio token of the plurality has a weighting factor and an

alphanumeric identifier, a subset of audio tokens in which the alphanumeric

identifier of each audio token of the subset corresponds to a DTMF sequence

equivalent to the DTMF-input-sequence;

sorting the subset according to the weighting factor to generate a sorted list of

audio tokens; and

for each audio token in the sorted list, successively playing a corresponding audio message.

9. The method of claim 8, wherein the DTMF-input-sequence has a one-to-one correspondence with the alphanumeric identifier.

10. The method of claim 9, wherein the playing pauses after a selected number of audio messages has been played.

11. The method of claim 10, wherein the playing pauses after a further input is received from the user.

12. In a voice response system having a telephone interface and a recognition grammar for recognizing a set of spoken utterances in which each spoken utterance of the set has an associated alphanumeric string identifier, a method of interpreting input comprising:

- receiving a DTMF key sequence over the telephone interface;
- determining a constrained recognition grammar to recognize a subset of spoken utterances, wherein the subset comprises each spoken utterance of the set that has an associated alphanumeric string identifier that maps to a DTMF sequence that is equivalent to the DTMF key sequence;
- playing a prompt over the telephone input to solicit a voice input;

in response to receiving the voice input over the telephone interface, processing the voice input against the constrained recognition grammar to determine a matching element of the subset; and playing an audio message corresponding to the matching element.

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Abstract

This invention relates in general to methods for receiving and interpreting an alphanumeric input string entered on a telephone keypad using one keystroke per input string character. The set of matching objects in a database are selected and sorted and presented to the user as an ordered list from which the user may select the desired item on the list through a further numeric keystroke entry or through a spoken selection that is matched against a restricted voice recognition grammar for improved recognition accuracy. In an alternative embodiment, the matching objects in the database are selected and sorted and the response associated with each matched object is presented in sorted sequence.

Fig 1

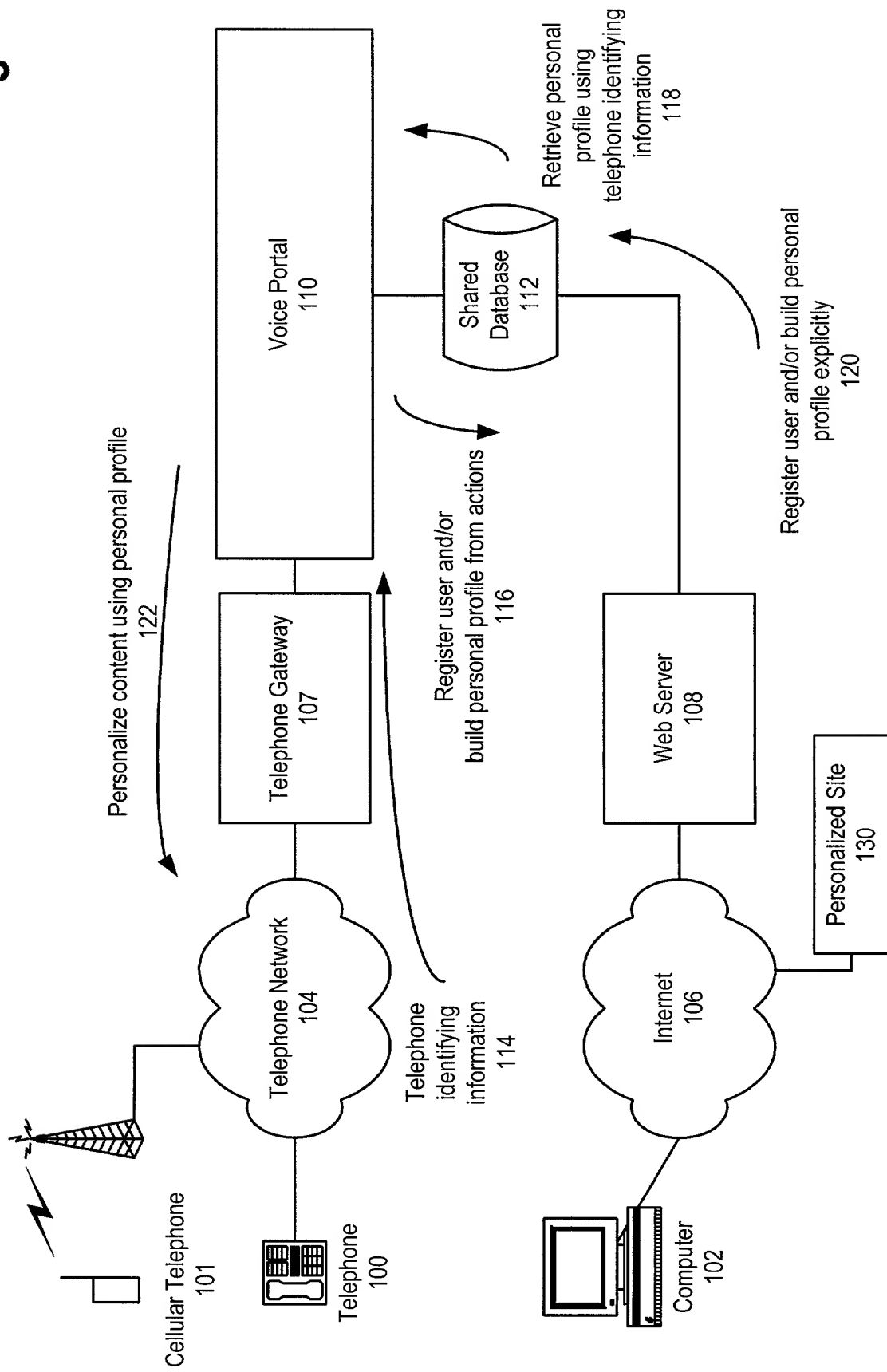


Fig 2

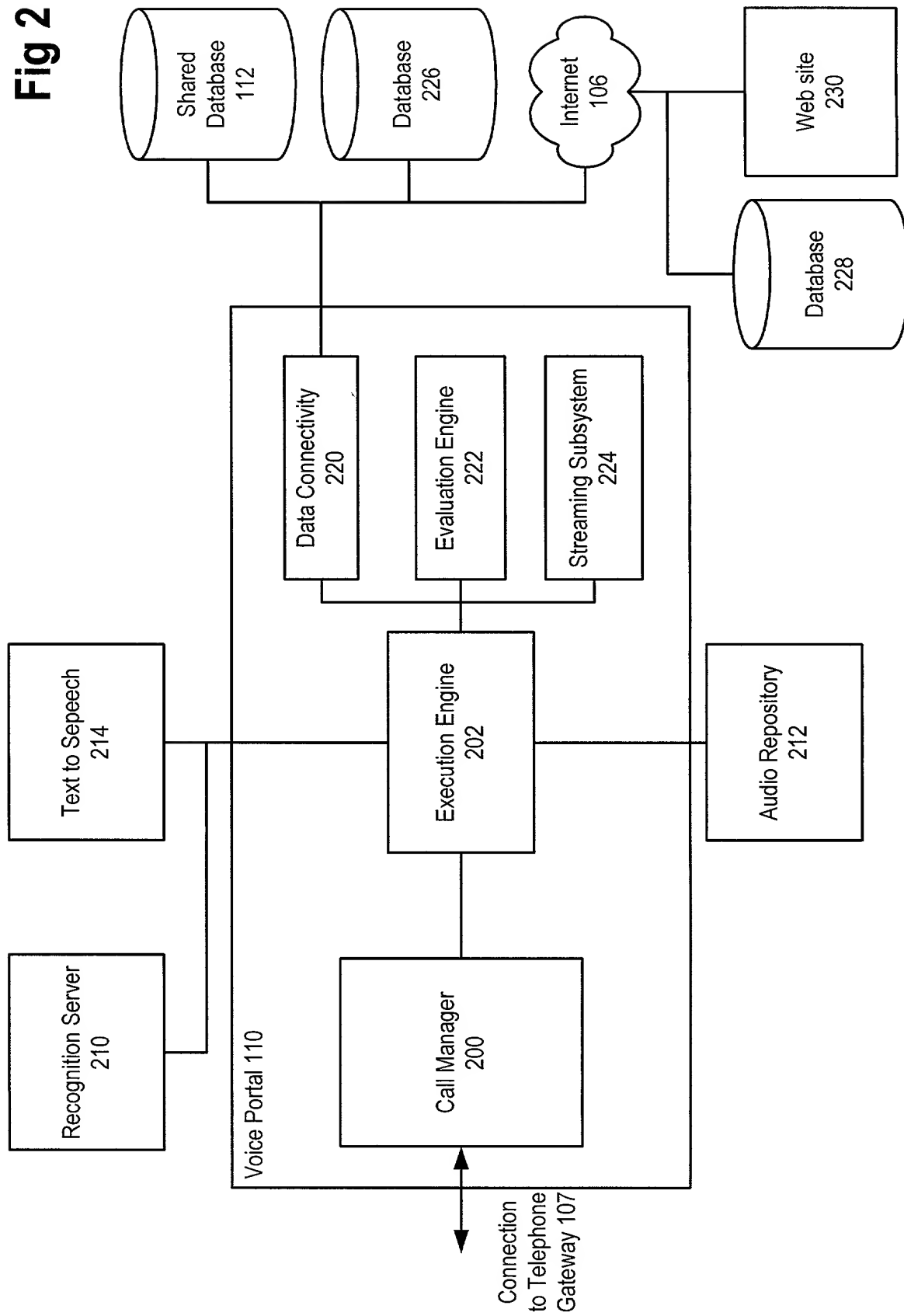
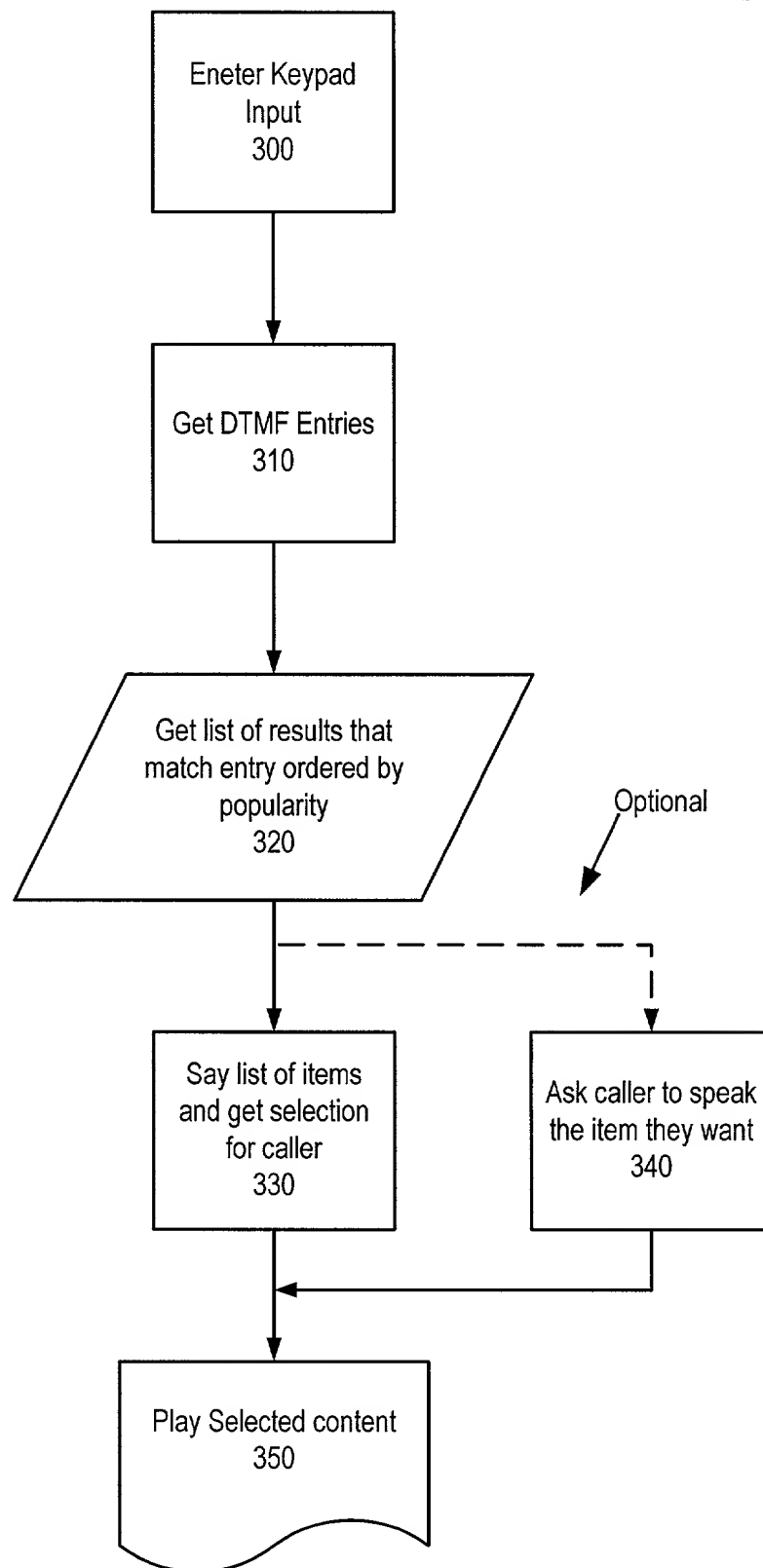



Fig 3



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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63) <input checked="" type="checkbox"/> Declaration Submitted with Initial Filing OR <input type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)	Attorney Docket Number	TM00-005.US
	First Named Inventor	Partovi, Hadi
	COMPLETE IF KNOWN	
	Application Number	
	Filing Date	
	Group Art Unit	
	Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

A Voice and Telephone Keypad Based Data Entry Method for Interacting with Voice Information Services

the specification of which (Title of the Invention)

☒ is attached hereto
OR

☐ was filed on (MM/DD/YYYY) as United States Application Number or PCT International

Application Number and was amended on (MM/DD/YYYY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 356(b) of any foreign application(s) for patent or inventor's certificate, or 356(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.
60/201,328	05/02/2000	

[Page 1 of 2]

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I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02C attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

☒ Customer Number **24488**

OR

☐ Registered practitioner(s) name/registration number listed below

Place Customer



Name	Registration Number	Name	Registration Number
			24488

PATENT, TRADEMARK OFFICE

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

Direct all correspondence to: ☒ Customer Number or Bar Code Label **24488** OR ☐ Correspondence address below

Name					
Address					
Address					
City		State		ZIP	
Country		Telephone		Fax	

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor:

☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	Family Name or Surname
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☒ Additional inventors are being named on the 2 supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto

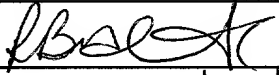
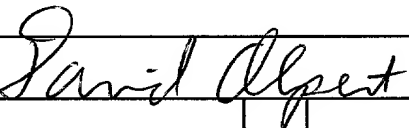
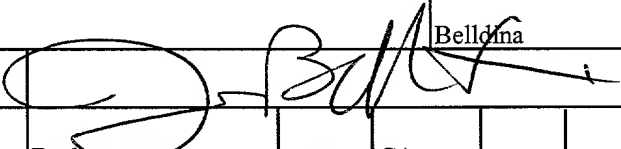
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ADDITIONAL INVENTOR(S) Supplemental Sheet Page 1 of 2

Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
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Inventor's Signature				Date	7/24/00		
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Inventor's Signature				Date	7/24/00		
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Post Office Address							
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ADDITIONAL INVENTOR(S)
Supplemental Sheet
Page 2 of 2

Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
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Inventor's Signature				Date			
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Post Office Address							
City	Mountain View	State	CA	ZIP	94043-4926	Country	
Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])				Family Name or Surname			
Inventor's Signature				Date			
Residence: City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
City		State		ZIP		Country	
Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])				Family Name or Surname			
Inventor's Signature				Date			
Residence: City		State		Country		Citizenship	
Post Office Address							
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004246-0240



POWER OF ATTORNEY BY ASSIGNEE TO EXCLUSION OF INVENTOR
UNDER 37 C.F.R. § 3.71 WITH REVOCATION OF PRIOR POWERS

The undersigned ASSIGNEE of the entire interest in:

- ☐ U.S. Patent No. ____
☒ U.S. application no. Not Yet Assigned, filed on Herewith

hereby appoints the following attorneys of Tellme Networks, Inc.:

Attorney Name	Reg. No.	Attorney Name	Reg. No.
Ted W. Chan	43,536	Erik L. Oliver	46,296

and all Tellme Networks, Inc., attorneys registered to practice before the United States Patent and Trademark Office, to prosecute this application and transact all business in the United States Patent and Trademark Office in connection therewith and hereby revokes all prior powers of attorney; said appointment to be to the exclusion of the inventors and the inventors' attorneys in accordance with the provisions of 37 C.F.R. § 3.71.

The following evidentiary documents establish a chain of title from the original owner to the Assignee:

(complete one of the following)

- ☒ a copy of an Assignment attached hereto, which Assignment has been (or is herewith) forwarded to the Patent and Trademark Office for recording; or
- ☐ the Assignment recorded on ____ at reel ____, frames ____ - ____.

Pursuant to 37 C.F.R. § 3.73(b) the undersigned Assignee hereby states that evidentiary documents have been reviewed and hereby certifies that, to the best of ASSIGNEE's knowledge and belief, title is in the identified ASSIGNEE.

Direct all correspondence and telephone calls to:

Name	Ted W. Chan				
Address	Tellme Networks, Inc.				
Address	1310 Villa Street				
City	Mountain View	State	CA	Zip	94041
Country	USA	Telephone	(650) 930-9000	Fax	(650) 930-9101

ASSIGNEE: Tellme Networks, Inc.

Name: _____

Hadi Partovi

Date: 24 Jul 2000

004225-022960